Spin Waves in Ferromagnetics and Antiferromagnetics I

S/053/60/071/004/001/004
B004/B056

magnetics. In the next issue of this periodical, the last part of this work will be published: II. Interaction among spin waves and between spin waves and lattice vibrations. Relaxation processes and kinetic processes. The authors mention papers by Ya. I. Frenkel' and Ya. G. Dorfman (Ref. 5), Ye. Lifshits (Ref. 8), L. Landau and Ye. Lifshits (Ref. 11), a paper by the authors in collaboration with S. Peletminskiy (Ref. 12), V. Gurevich (Ref. 30), A. Borovik-Romanov (Refs. 39,40), I. Dzyaloshinskiy (Ref. 41), Ye. Turov (Ref. 42), and N. N. Bogolyubov and S. V. Tyablikov (Ref. 15). There are 6 figures and 55 references: 36 Soviet, 13 US, 3 British, 2 Dutch, 3 French, and 3 German.

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S/053/60/072/001/001/005
B013/B060

9.4300 (1035,1138,1143)

AUTHORS: Akhiyezer, A. I., Bar'yakhtar, V. G., Kaganov, M. I.

TITLE: Spin Waves in Ferromagnetics and Antiferromagnetics. II

PERIODICAL: Uspekhi fizicheskikh nauk, 1960, Vol. 72, No. 1, pp. 3-32

TEXT: This is the second part of an article published in "Uspekhi fizicheskikh nauk", 1960, Vol. 71, 533, and is devoted to the interaction of spin waves with one another and with lattice vibrations and, furthermore, to the relaxation- and kinetic processes. § 10 deals with the fusion and splitting of spin waves and their scattering on spin waves. The authors restrict themselves to considering electrets and, therefore, take into account, aside from the interaction of spin waves with one another, also their interaction with phonons (Ref. 1). The Hamiltonians of the interaction of spin waves are set up, the use of which is restricted to the temperature range below the Curie temperature. The probabilities of fusion and splitting, as well as the scattering of spin waves, are calculated. § 11 deals with the interaction of spin waves with lattice vibrations. The interaction of spin waves with one

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another was found to be stronger than their interaction with the lattice. This allows the conclusion that the equilibrium in the spin wave system is more quickly brought about than the one between spin waves and lattice. For this reason, the temperatures of spin waves and lattice may differ. The temperature balance is discussed in § 12 together with the relaxation of the magnetic moment in electrets. The course of relaxation of the magnetic moment in electrets can be explained on the basis of the probabilities the authors established for the interaction processes. In § 13, the authors deal with the dispersion of magnetic permeability of a ferromagnetic dielectric. The complicated character of relaxation established in the preceding chapter influences the dependence of the electret susceptibility on frequency (Refs. 1,7). The case of a longitudinal magnetic alternating field polarized along the equilibrium magnetic moment is examined, i.e., the longitudinal component of magnetic permeability is calculated. When frequencies are sufficiently high it is more expedient not to speak of a calculation of susceptibility, but rather of an absorption coefficient of the photon. This coefficient is determined as the difference of the probabilities of all of the absorption and emission processes of the photon. A formula for determining the

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dependence of the photon absorption coefficient on frequency is given (13,20); it can be applied to all limiting cases. The last chapter of the present article (§ 14) deals with the thermal conductivity of electrets. It can be calculated from the spin wave interaction Hamiltonian and the spin wave phonon Hamiltonian, as well as the phonon - phonon interaction Hamiltonian. There are 10 Soviet references.

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S/185/61/006/003/003/010
D208/D302

24.7900 (1144,1147,1055)

AUTHORS: Bar'yakhtar, V.G. and Popov, V.O.

TITLE: On the thermodynamics of antiferromagnetics in a magnetic field

PERIODICAL: Ukrayins'kyy fizychnyy zhurnal, v. 6, no. 3, 1961, 340-351

TEXT: The heat capacity and magnetization of antiferromagnetics are calculated for a wide range of values of magnetic field and low temperatures; the effect of dipole-dipole interaction on the thermodynamic characteristics of antiferromagnetics is ascertained. Those antiferromagnetics are considered whose magnetic moment, in the absence of an external magnetic field, is oriented: a) along a selected axis and b) lies in the ground plane. In case a) (magnetic moment of sublattices oriented along a selected axis) the thermodynamic potential is given by:

$$\Omega = \sum_{j=1,2} \frac{T}{(2\pi)^3} \int d_{\varkappa} \ln\left(1 - e^{-\frac{\varepsilon_j(\varkappa)}{T}}\right) = -\frac{1}{24\pi^3} \sum_{j=1,2} \int \frac{k_j^3(\varepsilon_j)\, d\varepsilon_j\, dO_{\varkappa}}{e^{\frac{\varepsilon_j}{T}} - 1}, \qquad (1)$$

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where T is the temperature in ergs, $\mathcal{E}_j$ the energy of the spin wave and $d\Omega_k$ the elementary solid angle in the direction of the wave vector k. The magnetization and the heat capacity are

$$\mathfrak{M} = -\frac{\partial\Omega}{\partial H}, \quad C_s = -T\frac{\partial^2\Omega}{\partial T^2} \qquad (2)$$

The simplified expressions for the energy spectrum are

$$\mathcal{E}_1 = \mu\sqrt{Q_1 + D_1 - D_2}, \quad \mathcal{E}_2 = \mu\sqrt{Q_2 + D_2} \qquad (4)$$

(the terms D_j are due to the dipole interaction). The notations in this article were adopted from (Ref. 4: V.O. Popov, Ukr. fiz. zhurn., 6, 1, 1961). By using formulae from Ref. 4, the expressions for the potential become

$$\Omega = -\frac{T}{(2\pi)^{3/2} a^3}\left(\frac{T}{T\delta_1}\right)^3\left(\frac{\mu H\delta\beta_2}{T}\right)^{3/2}\left[2 + \left(\frac{\mu H_0}{T}\right)^2 + \frac{1}{12}\left(\frac{\mu H_0}{T}\right)^4\right]e^{-\frac{\mu H\delta\beta_2}{T}} \qquad (5)$$

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$$\Omega = -\frac{T}{a^3}\left(\frac{T}{T_{\delta 1}}\right)^3\left[\frac{\pi^2}{45} + \frac{1}{6}\left(\frac{\mu H_0}{T}\right)^2 + \frac{1}{16\pi}\left(\frac{\mu H_0}{T}\right)^3 \frac{H_0}{H_{\delta\beta 2}}\right] \qquad (6)$$

From (5) and (6) it follows that with external fields $H_0 \ll H_{\delta\beta 2}$, the dipole-dipole interaction practically does not affect Ω. In fields $\mu H_0 \sim T$, the relationship between field and magnetization is non-linear. With temperatures much higher or much lower than $\mu\sqrt{H_0^2 - H_{\delta\beta 1}^2}$, the relationship between field and magnetization will be linear. For $\Delta\mathfrak{M}$ the following expressions are given:

$$\Delta\mathfrak{M} = \mathfrak{M}(T) - \mathfrak{M}(0) =$$

$$= \frac{\mu}{a^3}\left[\frac{\pi^2}{30}\cdot\frac{H_0}{H_{\delta 1}}\cdot\frac{T}{\mu H_{\delta 1}}\left(\frac{T}{T_{\delta 1}}\right)^3 - \frac{\mu^3 H_0 (H_0^2 - H_{\delta\beta 1}^2)}{(2\pi)^{3/2} T_{\delta 1}^3} e^{-\frac{\mu\sqrt{H_0^2 - H_{\delta\beta 1}^2}}{T}}\right], \qquad (12)$$

$$\mu M_0 \ll T \ll \mu\sqrt{H_0^2 - H_{\delta\beta 1}^2};$$

$$\Delta\mathfrak{M} = -\frac{\mu}{12 a^3}\cdot\frac{\mu H_0}{T_{\delta 1}}\left(\frac{T}{T_{\delta 1}}\right)^3\left[1 - \frac{3}{\pi}\cdot\frac{\mu\sqrt{H_0^2 - H_{\delta\beta 2}^2}}{T}\right], \qquad (13)$$

$$\mu\sqrt{H_0^2 - H_{\delta\beta 1}^2} \ll T \ll T_{\delta 1}.$$

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From these it is evident that for $\mu\sqrt{H_0^2 - H_{\delta\beta 1}^2} \sim T$ the dependence of magnetization on the field H_0 is non-linear. As a result of the asymmetry of the surface energy, the thermal oscillations of the magnetic moments M_1 and M_2, corresponding to the second band of the energy spectrum of the antiferromagnetic, lead to the paramagnetic effect, and the thermal oscillations of the moments corresponding to the first band, to the diamagnetic effect. By using formulae from Ref. 4, the author obtains expressions for Ω, $\Delta\mathfrak{M}$, and C_s which show that the effect of the field on C_s decreases with temperature, diamagnetism appears, the terms with η become more effective. The dipole-dipole interaction does not affect Ω, $\Delta\mathfrak{M}$ and C_s. The authors conclude that the dipole-dipole interaction does not appreciably affect the magnetization and heat capacity except in the case that the external field H_0 has values near to its critical values H_δ and $H_{\delta\beta}$. This is due to the fact that the principal terms of the dipole-dipole interaction cancel each other. By taking into account the terms which contain $\eta = \left|\frac{H_0}{H_\delta}\right|^2$, it was found that in

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several cases the magnetization changes with temperature (for $T \ll \mu H \delta \beta$) according to the power law, and to the $e^{-\frac{A}{T}}$ law, which is usually assumed. At temperatures $T \gg \mu H \delta \beta$ it is also necessary to take these terms into consideration. The author expresses his thanks to O.I. Akhiyezer. There are 4 Soviet-bloc references.

ASSOCIATION: Fizyko-tekhnichnyy instytut AN UkrSSR (Physico-technical Institute of the AS UkrSSR) Khar'kov

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89228

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B102/B212

24.7900 (1147, 1158, 1160, 1144)

AUTHORS: Akhiyezer, I. A., Bar'yakhtar, V. G., Peletminskiy, S. V.

TITLE: Theory of high-frequency magnetic susceptibility of a ferrodielectric at low temperatures

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 40, no. 1, 1961, 365-374

TEXT: The ferromagnetic resonance line widths are commonly calculated by phenomenological methods using the relaxation term in accordance with Landau-Lifshits or Bloch. The authors of the present paper wanted to calculate the ferromagnetic resonance line shape by using quantum theory and basing on the microscopic theory of spin wave interactions. The magnetic susceptibility tensor is not determined as usually with the help of an equation of motion but with an application of field theory using Green's two-time function of spin waves. The calculation of Green's spin wave function is based on a Hamiltonian which takes into account both exchange interactions and relativistic interactions between spin waves; the interaction of these spin waves with lattice vibrations is neglected.

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The method employed is well suited to compute transverse components of the magnetic susceptibility tensor, used to determine the resonance line shape. If the magnetic susceptibility as a function of frequency and wave vector is known, it is possible to find the behavior of the relaxation of a magnetic moment. The relationship between susceptibility and Green function is investigated first. One obtains $\chi_{il}(\vec{k},\omega) = K^R_{il}(\vec{k},\omega)$, where the retarded two-time Green function is defined by

$$K^R_{il}(\vec{r}-\vec{r}',t-t') = i\theta(t-t')\langle[\hat{M}_i(\vec{r},t),\ \hat{M}_l(\vec{r}',t')]\rangle, \quad \theta(t) = \begin{cases} 0 & t<0 \\ 1 & t>0 \end{cases}$$
$$\langle f\rangle = \mathrm{Sp}\,\varrho_0 f,$$

with a Fourier expansion $K^R_{il}(\vec{r},t) = \frac{1}{(2\pi)^4}\int_{-\infty}^{+\infty} \exp(-i\omega t + i\vec{k}\vec{r}) K^R_{il}(\vec{k},\omega)\,d\vec{k}\,d\omega$. ϱ_0 denotes the density matrix without the external field. It is shown how the relaxation of the magnetic moment can be investigated if χ_{il} is known. Let there be a magnetic-moment distribution $\vec{m}^0(\vec{r})$ at $t=0$, assumed to be in equilibrium in the presence of a magnetic field $\vec{h}^0(\vec{r})$. This field is connected with the initial magnetic moment distribution by the following

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relation: $m_i^o(\vec{k}) = \chi_{il}(\vec{k},\omega)h_l^o(\vec{k})|_{\omega=0}$. The variable magnetic field is described by $\vec{h}(\vec{r},t) = \theta(-t)e^{\varepsilon t}\vec{h}^o(\vec{r})$, $\varepsilon\to+0$; and the relaxation of the magnetic moment is expressed by the relation:

$$m_i(\vec{r},t) = -\frac{i}{(2\pi)^4}\int d\vec{k}e^{i\vec{k}\vec{r}}k_l^o(\vec{k})\int_{-\infty}^{\infty}d\omega\frac{e^{-i\omega t}}{\omega}\left[\chi_{il}(\vec{k},\omega) - \chi_{li}^*(\vec{k},\omega)\right].$$

The relaxation is thus determined by the anti-hermitean part of the tensor χ_{il}; this part also determines the energy absorption of the variable magnetic field. In the following the connection between $K_{il}^R(\vec{r},t)$ and the Matsubara-Green function $\mathcal{K}_{il}(\vec{r},\tau)$ is defined by $\mathcal{K}_{il}(\vec{r}-\vec{r}',\tau-\tau') = \langle T_\tau\{\hat{M}_i(\vec{r},\tau)\hat{M}_l(\vec{r}',\tau')\}\rangle$, $\hat{M}_i(\vec{r},\tau) = e^{\mathcal{H}\tau}M_i(\vec{r})e^{-\mathcal{H}\tau}$, where T_τ is the chronological operator with respect to the variable τ, which is examined by employing the diagram technique. Using a method of A. A. Abrikosov, L. P. Gor'kov, I. Ye. Dzyaloshinskiy, and Ye. S. Fradkin one obtains: $\chi_{il}(\vec{k},\omega) = K_{il}^R(\vec{k},\omega) = \mathcal{K}_{il}(\vec{k},-i\omega+0)$. The magnetic susceptibility of a

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dielectric described by the Hamiltonian $\mathcal{H} = \mathcal{H}_0 + \mathcal{H}_3 + \mathcal{H}_4$ is then computed. $\mathcal{H}_0 = \sum_{\vec{k}} \varepsilon_{\vec{k}} c^+_{\vec{k}} c_{\vec{k}}$, where $\varepsilon_{\vec{k}}$ denotes the spin wave energy, $\mathcal{H}_3$ and $\mathcal{H}_4$ are given by

$$\mathcal{H}_3 = \frac{1}{\sqrt{V}} \sum_{1,2,3} \{\Phi(1, 2; 3) c_1^+ c_2^+ c_3 \Delta(k_1 + k_2 - k_3) + \text{к. с.} + \Phi_1(1, 2, 3) c_1^+ c_2^+ c_3^+ \Delta(k_1 + k_2 + k_3) + \text{к. с.}\}, \quad (19)$$

$$\mathcal{H}_4 = \frac{1}{V} \sum_{1,2,3,4} \{\Psi(1, 2; 3, 4) c_1^+ c_2^+ c_3 c_4 \Delta(k_1 + k_2 - k_3 - k_4) + \Psi_1(1, 2, 3; 4) c_1^+ c_2^+ c_3^+ c_4 \Delta(k_1 + k_2 + k_3 - k_4) + \text{к. с.} + \Psi_2(1, 2, 3, 4) c_1^+ c_2^+ c_3^+ c_4^+ \Delta(k_1 + k_2 + k_3 + k_4) + \text{к. с.}\}.$$

$$\varepsilon_k = \sqrt{A_k^2 - |B_k|^2}, \text{ где}$$

$$A_k = \Theta_c (ak)^2 + \mu(H_0 + \beta M_0) + 2\pi\mu M_0 \sin^2 \theta_k, \qquad B_k = 2\pi\mu M_0 \sin^2 \Theta_k e^{2i\varphi_k}.$$

μ denotes the double Bohr magneton, a is the lattice constant, Θ_0 is of the order of the Curie temperature, M_0 is the saturation magnetic moment, β the anisotropic constant, H_0 the constant outer magnetic field, $\theta_{\vec{k}}$ and

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$\varphi_{\vec{k}}$ are the polar angles of $\vec{k}$. Ψ and Φ are given by

$$\left.\begin{array}{l}\Psi(1,2;3,4) = -\mu(4M_0)^{-1}\theta_c a^2(k_1k_2+k_3k_4)\\ |\Psi_2| \ll |\Psi_1| \ll |\Psi|\end{array}\right\} \text{при } 1 \gg ak \gg \sqrt{\frac{\mu M_0}{\theta_c}}, \quad (20)$$

$$\begin{aligned}\Phi(1,2;3) = -\pi\mu\sqrt{2\mu M_0}\,(&\sin 2\theta_1(e^{-i\varphi_1}u_1^* + e^{i\varphi_1}v_1^*)(u_2^*u_3 + v_2^*v_3) + \\ &+ \sin 2\theta_2(e^{-i\varphi_2}u_2^* + e^{i\varphi_2}v_2^*)(u_1^*u_3 + v_1^*v_3) + \\ &+ \sin 2\theta_3(e^{i\varphi_3}u_3 + e^{-i\varphi_3}v_3)(v_1^*u_2^* + v_2^*u_1^*)),\end{aligned} \quad (21)$$

$$\left.\begin{array}{l}|\Phi_1| \sim |\Phi|; \quad |\Psi_1| \sim |\Psi_2| \sim |\Psi|\\ \Psi(1,2;3,4) = -{}^1/_2\mu^2\beta(u_1^*u_2^*u_3u_4 + 4u_1^*v_2^*v_3u_4 + v_1^*v_2^*v_3v_4)\end{array}\right\} \text{при } ak \ll \sqrt{\frac{\mu M_0}{\theta_c}}, \quad (22)$$

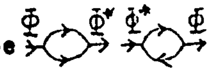
где [8]

$$u_k = \sqrt{(A_k+\varepsilon_k)/2\varepsilon_k}, \qquad v_k = -e^{2i\varphi_k}\sqrt{(A_k-\varepsilon_k)/2\varepsilon_k}.$$

One obtains:

$$\begin{aligned}\chi_{xx}(k,\omega) &= \tfrac{1}{2}\mu M_0 U_1(k)\{[\varepsilon_k-\omega-i\gamma(k)]^{-1} + [\varepsilon_k+\omega+i\gamma(k)]^{-1}\},\\ \chi_{yy}(k,\omega) &= \tfrac{1}{2}\mu M_0 U_2(k)\{[\varepsilon_k-\omega-i\gamma(k)]^{-1} + [\varepsilon_k+\omega+i\gamma(k)]^{-1}\},\\ \chi_{xy}(k,\omega) &= -\tfrac{1}{2}i\mu M_0\{U(k)[\varepsilon_k-\omega-i\gamma(k)]^{-1} - U^*(k)[\varepsilon_k+\omega+i\gamma(k)]^{-1}\},\\ \chi_{yx}(k,\omega) &= \tfrac{1}{2}i\mu M_0\{U^*(k)[\varepsilon_k-\omega-i\gamma(k)]^{-1} - U(k)[\varepsilon_k+\omega+i\gamma(k)]^{-1}\};\end{aligned} \quad (31)$$

$$\begin{aligned}U_1(k) &= |u_k|^2 + |v_k|^2 + u_k^*v_k + u_kv_k^*,\\ U_2(k) &= |u_k|^2 + |v_k|^2 - u_k^*v_k - u_kv_k^*,\\ U(k) &= 1 + u_k^*v_k - u_kv_k^*.\end{aligned} \quad (32)$$

with $\gamma(\vec{k}) = \mathrm{Im}\Sigma(\vec{k}, -i\varepsilon_{\vec{k}}+0)$. The relaxation of the transverse magnetic moment is then investigated, and using the relation mentioned above, the resonance line width $\gamma(\vec{k})$ is determined. Diagrams of the type 

are expressed in second perturbation theory approximation by

$$\mathrm{Im}\,\Sigma_{\Phi}(k, -i\omega+0) = (2\pi)^{-3}\int dk'\,|\Phi(k', k-k'; k)|^2[(n_{k'}+1)(n_{k-k'}+1) - n_{k'}n_{k-k'}]\,\delta(\omega-\varepsilon_{k'}-\varepsilon_{k-k'}) + 2(2\pi)^{-3}\int dk'\,|\Phi(k, k'; k+k')|^2[n_{k'}(n_{k+k'}+1) - (n_{k'}+1)\,n_{k+k'}]\,\delta(\omega+\varepsilon_{k'}-\varepsilon_{k+k'}). \quad (37)$$

For graphs of the type as shown in Figs. 4-5 formula (40) holds. Finally the resonance line shape is investigated; here it is necessary to know $\gamma(0) = \mathrm{Im}\Sigma(0, -i\varepsilon_0+0)$; ε_0 denotes the frequency of the homogeneous resonance which is a function of the shape of the body:
$\varepsilon_0 = \mu(H_0+\beta M_0)^{1/2}(H_0+\beta M_0+4\pi M_0)^{1/2}$. For two limiting cases

$$\gamma(0) = \begin{cases} \frac{2}{5\pi}\left(\frac{3}{8}\right)^{1/2}\mathrm{cth}\,\frac{\varepsilon_0}{4T}\left(\frac{\mu M_0}{\Theta_e}\right)^{1/2}\left(\frac{4\pi}{3}-\frac{H_0}{M_0}-\beta\right)^{1/2}\mu M_0, & \frac{4\pi}{3}-\frac{H_0}{M_0}-\beta \ll 1 \\ A\,\mathrm{cth}\,\frac{\varepsilon_0}{4T}\left(\frac{\mu M_0}{\Theta_e}\right)^{5/2}\left(\frac{H_0}{M_0}+\beta\right)^{1/2}\mu M_0, & \frac{H_0}{M_0}+\beta \ll 1 \end{cases} \quad (43)$$

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$$A = \frac{\pi}{4}\int_0^{\pi/6}\cos^2\vartheta\,\sqrt{1-4\sin^2\vartheta}\,d\vartheta.$$

holds, and $\gamma(\vec{k})$ is given by

$$\gamma(k) = -\mathrm{Im}\,\Sigma_{\psi}(k, -i\varepsilon_k + 0) = \frac{1}{4(2\pi^5)}\left(\frac{\mu\Theta_c}{M_0}\right)^2\left(\exp\frac{\varepsilon_k}{T} - 1\right)a^4\int dk'\,dk''\,(kk' + kk'' + k'k'' - k''^2)^2 (n_{k'} + 1)\, n_{k''} n_{k+k'-k''}\,\delta(\varepsilon_k + \varepsilon_{k'} - \varepsilon_{k''} - \varepsilon_{k+k'-k''}). \quad (46)$$

For $\varepsilon_k \sim T$ the following is valid $\gamma(\vec{k}) \approx (T/\theta_0)^4\theta_0$. Finally the authors thank A. I. Akhiyezer for suggestions. M. I. Kaganov and V. M. Tsukernik are mentioned. There are 5 figures and 12 references: 8 Soviet-bloc and 4 non-Soviet-bloc.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR (Institute of Physics and Technology, Academy of Sciences Ukrainskaya SSR)

SUBMITTED: July 18, 1960

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AKHIYEZER, I.A.; BAR'YAKHTAR, V.G.; PELETMINSKIY, S.V.

Theory of high frequency magnetic susceptibility of ferrodielectrics at low temperatures. Zhur. eksp. i teor. fiz. 49 no.1:365-374 Ja '61. (MIRA 14:6)

1. Fiziko-tekhnicheskiy institut AN Ukrainskoy SSR.
(Dielelectrics--Magnetic properties)

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S/181/62/004/012/017/052
B104/B102

AUTHORS: Maleyev, S. V., Bar'yakhtar, V. G., and Suris, R. A.

TITLE: The scattering of slow neutrons from complex magnetic structures

PERIODICAL: Fizika tverdogo tela, v. 4, no. 12, 1962, 3461-3470

TEXT: The elastic scattering of slow polarized neutrons is investigated for magnetic substances in which the orientation of the atomic spins changes periodically from one atom to the other (e.g. Dy, Er and others). The period of these changes depends on the lattice constant and on temperature. Starting from the representation of the neutron scattering amplitude as given by O. Halpern and M. Jonson (Phys. Rev., 55, 898, 1939), the equations

$$\sigma^{(\pm)}_{mi}(\mathbf{q}) = r_0^2\gamma^2 F^2(\mathbf{q})\langle S^2\rangle e^{-2W_q} d(\mathbf{q}\pm\mathbf{k})(L_i^2+M_i^2\pm 2\mathbf{P}_0[\mathbf{L}_i\mathbf{M}_i]), \quad (15)$$

$$\mathbf{P}^{(\pm)}_{mi}(\mathbf{q}) = \frac{2(\mathbf{L}_i\mathbf{P}_0)\mathbf{L}_i + 2(\mathbf{M}_i\mathbf{P}_0)\mathbf{M}_i - \mathbf{P}_0(L_i^2+M_i^2) \mp 2[\mathbf{L}_i,\mathbf{M}_i]}{L_i^2+M_i^2\pm 2\mathbf{P}_0[\mathbf{L}_i\mathbf{M}_i]}. \quad (16)$$

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are obtained for the scattering cross section and for the polarization of the scattered neutrons. Here $\vec{q}$ is the momentum transferred to the crystal by the neutron, $\vec{k}$ is the wave vector of the neutron, $\vec{L}_i$ = Re $\vec{N}_i$ and $\vec{M}_i$ = Im $\vec{N}_i$, S_l is the spin of a magnetic atom,

$$N_{0,i} = a_{0,i} - (a_{0,i}e)\,e.$$

$$\varepsilon_{\zeta l} = a_0 + \sum_i (a_i e^{-i k_i R_l} + a_i^* e^{i k_i R_l}), \qquad (7),$$

$$S_l = \varepsilon_{\zeta l} S_{\zeta l} + \varepsilon_{\eta l} S_{\eta l} + \varepsilon_{\zeta l} S_{\zeta l}, \qquad (6),$$

$\varepsilon_{\zeta l}$ is the unit vector in the direction $\langle \bar{S}_l \rangle$. From (16) it follows that the scattered neutrons are polarized along the vector $[\vec{L}_i \vec{M}_i]$ if the incident neutrons are unpolarized. For determining the vectors $\vec{a}_i$ and $\vec{a}_i^*$, the vectors $\vec{L}_i$ and $\vec{M}_i$ must be known for two different reflections, whereby the angle between the two vectors $\vec{q} = \vec{q}\cdot\vec{q}^{-1}$ must not be small. The determination of the vectors $\vec{L}_i$ and $\vec{M}_i$ for a fixed reflection is discussed. Finally, the scattering from the following structures are discussed: (1) Simple umbrella structure; (2) modulated umbrella structure; (3) umbrella structure with revolution; (4) slanted fence; (5) linear spin wave.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR, Leningrad (Physicotechnical Institute imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: July 6, 1962

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37259
S/057/62/032/005/006/022
B125/B102

AUTHORS: Bar'yakhtar, V. G., and Kaganov, M. I.

TITLE: Homogeneous and inhomogeneous resonance in plasma

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 32, no. 5, 1962, 554-558

TEXT: The equations $(\partial/\partial x_i)\varepsilon_{ik}(\omega)E_k = 0$, curl $\vec{E} = 0$, which are valid inside, and curl $\vec{E} = 0$, div $\vec{E} = 0$ which are valid outside a plasma-filled volume, have to be solved in order to determine the natural frequencies ω_1, ω_2, and ω_3 of longitudinal plasma oscillations in a bounded volume. This problem is solvable only for a plasma contained in an ellipsoid. Some of the solutions correspond to a uniform field within the ellipsoid, and their natural frequencies are determined from $|\delta_{ik} + 4\pi n_{il}\chi_{lk}(\omega)| = 0$, where n_{ik} is the tensor of the demagnetizing factors. If the field is parallel to one of the ellipsoid axes, the homogeneous resonance frequencies are given by

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$$\left.\begin{aligned}\omega_{1,2}^2 &= \frac{\omega_H^2+(n_1+n_2)\Omega^2}{2} \pm \sqrt{\frac{1}{4}\left(\omega_H^2+(n_1+n_2)\Omega^2\right)^2 - n_1 n_2 \Omega^4} \\ \omega_3^2 &= n_3\Omega^2.\end{aligned}\right\} \qquad (11).$$

This leads to the following special cases: For an ellipsoid of revolution ($n_1 = n_2 \neq n_3$) or a sphere, one finds

$$\omega_{1,2}^2 = \frac{1}{2}\left[\omega_H^2 + 2n_1\Omega^2 \pm \omega_H\sqrt{\omega_H^2+4n_1\Omega^2}\right], \quad \omega_3 = \sqrt{1-2n_1}\,\Omega. \qquad (12) \text{ and}$$

Сфера ($n_1 = n_2 = n_3 = 1/3$)

$$\left.\begin{aligned}\omega_{1,2}^2 &= \frac{1}{2}\left[\omega_H^2 + \frac{2}{3}\Omega^2 \pm \omega_H\sqrt{\omega_H^2+\frac{4}{3}\Omega^2}\right], \\ \omega_3 &= \frac{1}{\sqrt{3}}\Omega.\end{aligned}\right\} \qquad (13),$$

respectively; for a cylinder with the axis parallel to the magnetic field,

$\omega_{1,2}^2 = \frac{1}{2}\left(\omega_H^2 + \Omega^2 \pm \omega_H\sqrt{\omega_H^2 + 2\Omega^2}\right)$, $\omega_3 = 0$; for a cylinder with the axis perpendicular to the magnetic field, $\omega_1^2 = \omega_H^2 + \Omega^2/2$, $\omega_2 = 0$, $\omega_3^2 = \Omega^2/2$; for a plane-parallel plate perpendicular or parallel to the magnetic field, $\omega_1^2 = \omega_H^2$, $\omega_2 = 0$, $\omega_3^2 = \Omega^2$ (16), and $\omega_1^2 = \omega_H^2 + \Omega^2$, $\omega_2 = 0$, $\omega_3 = 0$, respectively. In addition to the homogeneous resonance frequencies resulting from (11), there also exist inhomogeneous resonance frequencies which are difficult to calculate and correspond to solutions with a uniform field. The natural frequencies of a plasma bounded by two planes perpendicular to the magnetic field are given by

$$\omega_{1,2}^2 = \frac{\omega_H^2 + \Omega^2}{2} \pm \frac{1}{2}\sqrt{(\omega_H^2 + \Omega^2)^2 - 4\frac{v^2}{u^2 + v^2}\omega_H^2\Omega^2}. \qquad (23).$$

The parameters u and v are interrelated by dispersion equations having a different form for solutions either symmetric or antisymmetric, depending on the substitution of -z for z: cotan v = $(v/u)\varepsilon_3(\omega_{1,2})$ and tan v = $-(v/u)\varepsilon_3(\omega_{1,2})$, respectively. These equations provide a simple graphic solution if v is real. The natural frequencies of an ellipsoid are "very similar" to those of a plate. The present calculation of natural frequencies is suited to every case where the characteristic frequencies of the dielectric constant ε_{ik} satisfy the condition $c/\omega \gg L$ (L = dimensions of the system). A plasma cylinder with the axis perpendicular to the magnetic field has natural frequencies given by (23) with cotan v = $\frac{v}{u}\varepsilon_3(\omega_{1,2})$ for the symmetrical solutions, and tan v = $-\frac{v}{u}\varepsilon_3(\omega_{1,2})$ for the antisymmetrical ones. In the case of a magnetic field parallel to the cylinder axis one finds

$$\omega_{1,2}^2 = \frac{\omega_H^2 + \Omega^2}{2} \pm \frac{1}{2}\sqrt{(\omega_H^2 + \Omega^2)^2 - 4\frac{u^2}{u^2 + v^2}\omega_H^2\Omega^2}, \quad (28) \text{ with}$$

$$\frac{\varepsilon_1(\omega)\, vJ_n'(v) - \varepsilon_2(\omega)\, nJ_n(v)}{J_n(v)} = u\frac{K_n'(u)}{K_n(u)}, \quad (29),$$

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where $J_n(x)$ and $K_n(x)$ are Bessel and MacDonald functions, respectively. A. I. Akhiyezer is thanked for a discussion. The English-language reference is: L. Walker. Phys. Rev., 105, 309, 1957.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN USSR Khar'kov (Physicotechnical Institute AS UkrSSR, Khar'kov)

SUBMITTED: November 1, 1960 (initially)
July 21, 1961 (after revision)

9.9845
24.6716
24.2120

34649
S/056/62/042/002/037/055
B108/B104

AUTHORS: Akhiyezer, A. I., Aleksin, V. F., Bar'yakhtar, V. G., Peletminskiy, S. V.

TITLE: Influence of radiative effects on relaxation of electrons and electric conductivity of a plasma in a strong magnetic field

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 42, no. 2, 1962, 552 - 564

TEXT: This paper is to show that emission and absorption of electromagnetic waves by plasma electrons may have a considerable effect on the establishment of the thermal equilibrium of the electrons. Equilibrium of the absolute magnitude of the transverse electron momentum can be reached at nonrelativistic temperatures ($T \ll m_0 c^2$) and of the transverse as well as of the longitudinal components of the electron momentum at relativistic temperatures ($T \gtrsim m_0 c^2$). The radiative relaxation time has the order of magnitude of the ratio of mean electron energy to mean intensity of electron emission in a magnetic field. If this relaxation time is less than the mean time

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between two Coulomb collisions then it will also determine relaxation with respect to the corresponding variable. This means it will determine the time of equilibrium distribution of the electrons with respect to their absolute transverse momentum in the nonrelativistic case. The radiative relaxation time is of the order of unity at $H = 2\cdot10^5$ gauss, $T = 10^{-2}\ m_0c^2$, and an electron density of $10^3\ cm^{-3}$, and it decreases with increasing H and T and with decreasing electron density. The transverse component of the electric conductivity of a plasma is determined by the Coulomb collisions as well as by radiative effects. The longitudinal component on the other hand is determined by the Coulomb collisions only. Owing to this fact, electric conductivity of a plasma may be highly anisotropic. Beside the electron relaxation, also a relaxation of the photons occurs which manifests itself in a quasi-equilibrium distribution of the photons. This distribution which is determined by the instantaneous electron distribution reaches equilibrium, i. e., Rayleigh-Jeans distribution somewhat after electron relaxation. L. D. Landau, M. A. Leontovich, and K. N. Stepanov are thanked for discussions. Mention is made of B. A. Trubnikov, A. Ye. Bazhanova (Sb. Fizika plazmy i problema upravlyayemykh termoyadernykh reaktsiy (Plasma

Influence of radiative ...

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physics and problems of controlled thermonuclear reactions), 3, Izd. AN SSSR, p. 121), V. S. Kudryavtsev. (idem, p. 114) and L. E. Gurevich, S. T. Pavlov (ZhTФ, 30, 41, 1960). There are 7 Soviet references.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR (Physicotechnical Institute of the Academy of Sciences of the Ukrainskaya SSR)

SUBMITTED: August 21, 1961

Card 3/3

AKHIYEZER, A.I.; BAR'YAKHTAR, V.G.; PELETMINSKIY, S.V.

Effect of radiation processes on transport phenomena in a plasma in a high magnetic field. Zhur. eksp. i teor. fiz. 43 no.5:1743-1749 N '62. (MIRA 15:12)

1. Khar'kovskiy gosudarstvennyy universitet.
(Plasma (Ionized gases))
(Magnetic fields)

BAR'YAKHTAR, ~~V.G.;~~ MAKAROV, V.I.

Oscillations of tunnel current in a magnetic field. Dokl. AN SSSR 146 no.1:63-64 S '62. (MIRA 15:9)

1. Fiziko-tekhnicheskiy institut AN Ukrainskoy SSR. Predstavleno akademikom N.N. Bogolyubovym.
(Electric currents) (Magnetic fields)

AKHIYEZER, A. I., BARYAKHTAR, V. G.

"Relaxation Processes in Ferro- and Antiferromagnets."

report submitted for the Conference on Solid State Theory, held in Moscow, December 2-12, 1963, sponsored by the Soviet Academy of Sciences.

S/181/63/005/004/031/047

Relaxation processes in...

S/181/61/003/004/031/030

S/181/63/005/004/034/047
B102/B186

AUTHORS: Bar'yakhtar, V. G., and Maleyev, S. V.

TITLE: Inelastic scattering [illegible] spiral magnetic structure

PERIODICAL: Fizika tverdogo tela, v. [illegible]

[illegible]

ASSOCIATION: [illegible]
[illegible] Physicotechnical Institute imeni A. F. Ioffe AS USSR,
[illegible] Fiziko-tekhnicheskiy institut AN [illegible] Kiyev
(Physicotechnical Institute AS UkrSSR Kiyev)

Card 1/2

SAVCHENKO, M.A.; BAR'YAKHTAR, V.G.

Theory of relaxation processes in antiferromagnetics with a helical structure. Fiz. tver. tela 5 no.10:2747-2755 O '63. (MIRA 16:11)

1. Fiziko-tekhnicheskiy institut AN UkrSSR, Khar'kov.

ACCESSION NR: AP4017033 S/0141/63/006/006/1115/1128

AUTHORS: Bar'yakhtar, V. G.; Peletminskiy, S. V.

TITLE: Kinetic equations for plasma electrons and the photons radiated by them in a strong magnetic field

SOURCE: IVUZ. Radiofizika, v. 6, no. 6, 1963, 1115-1128

TOPIC TAGS: kinetic equations, transport equations, plasma, plasma in magnetic field, plasma electrons, plasma electron photons, electron photon correlation, perturbation theory, second order perturbation theory, absorption in plasma, radiation from plasma, radiation collision integral, transport phenomena

ABSTRACT: Kinetic equations, with allowance for the absorption and radiation, are derived for the electrons of a plasma situated in a strong magnetic field from the system of equations for the electron and photon correlation functions. In particular, the radiation col-

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ACCESSION NR: AP4017033

lision integrals for an inhomogeneous plasma, which are essential for investigation of transport phenomena, are derived and the currents in the inhomogeneous plasma determined. The electron and photon correlations in second approximation of perturbation theory are neglected, as are the effects connected with plasma polarization. "The authors express deep gratitude to A. I. Akhiyezer for a discussion of the obtained results." Orig. art. has: 37 formulas.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN UkrSSR (Physicotechnical Institute, AN UkrSSR)

SUBMITTED: 01Feb63 DATE ACQ: 18Mar64 ENCL: 00

SUB CODE: PH NO REF SOV: 003 OTHER: 002

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L 14279-63 EWT(1)/BDS/EEC(b)-2 AFFTC/ASD Pi-4 GG/IJP(C)

ACCESSION NR: AP3005280

L 14279-63

Card 2/2

APPROVED FOR RELEASE: 06/06/2000 CIA-RDP86-00513R000203810009-8"

BARYAKHTAR, V. G.

"Amplification of spin waves by beam of charged particles."

report submitted for 10th Annual Conf, Magnetism & Magnetic Materials, Minneapolis, 16-19 Nov 64.

ACCESSION NR: AP4011759 S/0181/64/006/001/0219/0227

AUTHORS: Peletminskiy, S. V.; Bar'yakhtar, V. G.

TITLE: Theory of high frequency susceptibility of uniaxial ferromagnetics

SOURCE: Fizika tverdogo tela, v. 6, no. 1, 1964, 219-227

TOPIC TAGS: susceptibility, magnetic susceptibility, high frequency susceptibility, ferromagnetic, uniaxial ferromagnetic, ferromagnetic resonance, spin wave, magnetic anisotropy, spin wave interaction, Breit line

ABSTRACT: The authors have examined the form and width of the lines of homogeneous ferromagnetic resonance in uniaxial ferromagnetics in the field of low temperatures. To compute the magnetic susceptibility they used the formalism of spin waves as developed by F. Dyson (Phys. Rev., 102, 1217, 1230, 1956). In the case of homogeneous precession, the width of the line of ferromagnetic resonance is associated only with interaction between spin waves resulting from magnetic anisotropy. When the temperature of a body is much greater than the frequency of ferromagnetic resonance, but considerably less than the Curie point, and when the spin is sufficiently large, the line of ferromagnetic resonance has a Breit form and the

ACCESSION NR: AP4011759

width of the line is proportional to T^2 (which is in agreement with the results of I. A. Akhiyezer, V. G. Var'yakhtar, and S. V. Peletminskiy. ZhETF, 40, 365, 1961). When the temperature of the body is much lower than the frequency of ferromagnetic resonance, the line is very asymmetrical relative to the resonance frequency, and the width of the line is exponentially small. In this field of very low temperature, computations are made without the normal assumption that the atomic spin is large (that is, much larger than one). "The authors thank A. I. Akhiyezer and I. A. Akhiyezer for their discussions of the work." Orig. art. has: 4 figures and 33 formulas.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN UkrSSR, Khar'kov(Physical and Technical Institute AN UkrSSR)

SUBMITTED: 24Jul63 DATE ACQ: 14Feb64 ENCL: 00

SUB CODE: PH NO REF SOV: 008 OTHER: 003

Card 2/2

ACCESSION NR: AP4013499 S/0181/64/006/002/0424/0429

AUTHORS: Bar'yakhtar, V. G.; Sinepol'skiy, O. I.

TITLE: Scattering of slow neutrons in antiferromagnetics with weak ferromagnetism

SOURCE: Fizika tverdogo tela, v. 6, no. 2, 1964, 424-429

TOPIC TAGS: neutron scattering, slow neutron, antiferromagnetic material, ferromagnetism, elastic scattering, inelastic scattering, nuclear scattering, neutron polarization

ABSTRACT: This study resulted from recent interest in antiferromagnetics with weak ferromagnetism and the fact that one branch of the spin waves has a very low activation energy. These waves have a substantial effect on the thermodynamic and kinetic properties of such antiferromagnetics. The authors have computed the cross section and polarization of elastic and inelastic scattering in Mn, Ni, and Co carbonates. In examining the inelastic scattering they have begun with the phenomenological theory of spin waves. It is shown that, along with magnetic scattering from planes for which the sum of the indices is odd, scattering also takes place in these antiferromagnetics from planes for which the sum of the

ACCESSION NR: AP4013499

indices is even, the intensity of the scattering being proportional to the square of the average magnetic moment in the body. When unpolarized neutrons are scattered, polarization develops in the scattered beam through interference of magnetic and nuclear scattering. The degree of polarization is proportional to the antiferromagnetic vector for reflection from planes with odd index totals, to the ferromagnetic moment for reflections from planes having even index sums. Orig. art. has: 1 figure and 19 formulas.

ASSOCIATION: none

SUBMITTED: 29Jul63 DATE ACQ: 03Mar64 ENCL: 00

SUB CODE: NP, MT NO REF SOV: 008 OTHER: 001

BR

ACCESSION NR: AP4034925 S/0181/64/006/005/1435/1438

AUTHORS: Bar'yakhtar, V. G.; Savchenko, M. A.; Shishkin, L. A.

TITLE: High frequency magnetic susceptibility of magnets with spiral ferromagnetic structure

SOURCE: Fizika tverdogo tela, v. 6, no. 5, 1964, 1435-1438

TOPIC TAGS: magnetic susceptibility, spiral ferromagnetic structure, ferromagnetic resonance, atomic spin, exchange interaction, susceptibility tensor, Bohr magneton, Heisenberg principle

ABSTRACT: The authors worked out the high-frequency susceptibility tensor for materials with spiral ferromagnetic structure. As shown by B. R. Cooper, R. I. Elliot, S. I. Nettel, and H. Suhl (Phys. Rev., 127, 57, 1962), such materials, unlike the usual ferromagnets, possess two resonant frequencies. One is comparatively small and lies in the frequency range of ferromagnetic resonance; the other, which is the result of exchange interactions of atomic spins, is essentially dependent on the pitch of the spiral and lies in the optical range. For simplicity the authors neglected the effects of attenuation and assumed that the spin waves

ACCESSION NR: AP4034925

did not interact with each other. Orig. art. has: 14 formulas.

ASSOCIATION: Fiziko-tekhnicheskiy institut, AN UkrSSR, Khar'kov (Physicotechnical Institute, AN UkrSSR)

SUBMITTED: 28Nov63 DATE ACQ: 20May64 ENCL: 00

SUB CODE: EM NO REF SOV: 001 OTHER: 005

Card 2/2

L 10520-65

BAR'YAKHTAR, V.G.; SAVCHENKO, M.A.; GANN, V.V.; RYABKO, P.V.

Coupled magnetoelasic waves in antiferromagnetics with a magnetic structure of the $MnCO_3$ type. Zhur. eksp. i teor. fiz. 47 no.5:1989-1994 N '64. (MIRA 18:2)

1. Fiziko-tekhnicheskiy institut AN UkrSSR.

ACCESSION NR: AP4043635 S/0056/64/047/002/0593/0597

AUTHORS: Bar'yakhtar, V. G.; Makhmudov, Z. Z.

TITLE: Concerning the coherent amplification of spin waves by a beam of charged particles

SOURCE: Zh. eksper. i teor. fiz., v. 47, no. 2, 1964, 593-597

TOPIC TAGS: spin wave theory, coherent spin wave, charged particle distribution, resonance scattering, distribution function, ferromagnetism

ABSTRACT: Unlike an earlier investigation by A. Akhiyezer et al. (ZhETF, v. 45, 337, 1963) the present authors studied the amplification of spin waves in a ferromagnet, based on coherent interaction between a beam of charged particles and the spin waves, for the case when the particle velocity in the beam has not only a longitudinal but also a transverse component (relative to the magnetic field).

ACCESSION NR: AP4043635

The excitation conditions are derived from the Maxwell equations and the kinetic equation for the particle distribution function in the beam. It is shown that the amplification is particularly large if the resonance condition

$$\omega(k) = k_{\parallel}v_{\parallel} + s\omega_{B},$$

is satisfied, where $\omega(k)$ -- frequency of spin waves with wave vector k, $v_{\parallel}$ -- longitudinal particle velocity, ω_B -- cyclotron frequency of the electron. The growth increment is proportional to the cube root of the particle density in the beam, provided the density is small. Orig. art. has: 12 formulas. "The authors thank A. I. Akhiyezer and K. N. Stepanov for a discussion of the work."

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk UkrSSR (Physicotechnical Institute, Academy of Sciences UkrSSR).

ACCESSION NR: AP4043635

SUBMITTED: 18Feb64 ENCL: 00

SUB CODE: NP, SS NR REF SOV: 003 OTHER: 000

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APPROVED FOR RELEASE: 06/06/2000 CIA-RDP86-00513R000203810009-8"

[illegible]
ACC NR: [illegible] SOURCE CODE: UR/3177/[illegible]/244/[illegible]

AUTHOR: Bar'yakhtar, V. G.; Makarov, V. I.

ORG: None

TITLE: Concerning the influence of pressure on the temperature of the superconducting transition

SOURCE: AN UkrSSR. Fiziko-tekhnicheskiy institut. Doklady, no. 244/T-029, 1965. K voprosu o vliyanii davleniya na temperaturu sverkhprovodyashchego perekhoda, 1-6

TOPIC TAGS: superconductivity, phase transition, critical point, critical magnetic field, pressure effect, conduction electron, crystal lattice

ABSTRACT: In view of the lack of a theoretical explanation for the fact that in some superconductors the temperature of the superconducting transition T_k increases under pressure and in others it decreases, the authors use the already-known expression for T_k to determine an expression for the derivative of T_k with respect to pressure in terms of the experimentally observed quantities, namely the Gruneisen constants of the electrons and of the lattice and the coefficient of compressibility of the metal. The values obtained for this derivative theoretical-

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ACC NR: AT6006416

ly are compared with the experimental values for Al, In, Pb, Hg_{α}, Sn, Cd, Zn, La_{β}, Nb, Ta, V, Zr, and Mo and are found to be in satisfactory agreement with experiment. An expression is also given for the derivative of the critical magnetic field with respect to the pressure in terms of the Gruneisen constants and the compressibility. This makes it possible to calculate the sign and magnitude of this derivative for different metals and compare them with the experimental values. These too are found to be in fair agreement. A certain anomaly in the case of thallium in the region of pressures up to 6000 atm is probably connected with singularities of the energy spectrum of the conduction electrons. The values for Ga, Re, Ru, Th, and Ti could not be compared with experiment for lack of the Gruneisen constants. The authors thank B. G. Lazarev for a discussion of the work. Orig. art. has: 7 formulas.

SUB CODE: 20/ SUBM DATE: 00/ ORIG REF: 006/ OTH REF: 009

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APPROVED FOR RELEASE: 06/06/2000 CIA-RDP86-00513R000203810009-8"

Card 1/2

ACCESSION NR: AP5017302 UR/0181/65/007/007/2082/2087

AUTHORS: Makhmudov, Z. Z.; Bar'yakhtar, V. G.

TITLE: On the instability of electric current in semiconductors, connected with excitation of spin waves

SOURCE: Fizika tverdogo tela, v. 7, no. 7, 1965, 2082-2087

TOPIC TAGS: ferrite, antiferromagnetic material, spin wave, semiconductor conductivity

ABSTRACT: It is shown that spin waves become coherently amplified by an electric current if the electron drift velocity exceeds the phase velocity of the spin waves. To determine the interaction between the spin waves and the electrons or holes in ferrites and antiferromagnets, the authors first calculate the dielectric tensor from the kinetic equation, assuming that the principal scattering mechanism is scattering of electrons by impurities. The growth increments of the spin waves are then determined for the interaction of spin waves with a constant electric current in antiferromagnets, the

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L 3343-66

ACCESSION NR: AP5017302

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electric field being directed along the preferred axis of the antiferromagnet. When the drift velocity exceeds the phase velocity of the waves, the components of the conductivity tensor reverse sign, and this leads to growth of the spin waves. The growth increment is directly proportional to the conductivity of the ferrite and can reach values 10^{-2}. 'The authors thank A. I. Akhiyezer for a discussion of the work.' Orig. art. has: 23 formulas.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN UkrSSR, Khar'kov (Physicotechnical Institut AN UkrSSR); Fizicheskiy institut AN AzSSR, Baku (Physics Institut AN AzSSR)

SUBMITTED: 27Jan65 ENCL: 00 SUB CODE: SS

NR REF SOV: 004 OTHER: 000

Card 2/2 LP

ACC NR: AP5020709 SOURCE CODE: UR/0141/65/008/005/0942/0947

AUTHOR: Shishkin, L. A.; Bar'yakhtar, V. G.

ORG: Physicotechnical Institute of Low Temperatures, AN UkrSSR (Fiziko-tekhnicheskiy institut nizkikh temperatur AN UkrSSR)

TITLE: Contribution to the theory of coherent amplification of magnetostatic oscillations by an electron beam

SOURCE: IVUZ. Radiofizika, v. 8, no. 5, 1965, 942-947

TOPIC TAGS: ferrite, magnetic resonance, electron beam, coherent scattering

ABSTRACT: This is a continuation of earlier work by one of the authors (Bar'yakhtar, with A. I. Akhiyezer and S. V. Peletminskiy, Phys. Letters v. 4, 129, 1963 and ZhETF v. 45, 337, 1963; with Z. Z. Makhmudov, ZhETF v. 47, 593, 1964), who showed that the spin waves can be coherently amplified in infinite ferro- and antiferromagnets by a beam of charged particles. The present article deals with the interaction between an electron beam and magnetization oscillations in a finite magnet, where the shape of the body affects the spin-wave spectrum. Only the principal natural oscillation modes (Walker Modes, Phys. Rev. V. 105, 390, 1957, which are extensively used in microwave electronics, are considered, and exchange

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L 4969-66
ACC NR: AP5026709

interaction is neglected. The authors determine the increments of the fundamental modes of the magnetostatic oscillations in a ferrite plate and show that the increment reaches a maximum when one of the resonant conditions is satisfied: $\omega = \beta v_0 - \omega_H$ (ω_H-- frequency of the magnetostatic oscillations of the plate, v--beam velocity, β--wave vector). The increment is proportional to the square root of the charge density in the beam. The fields decrease outside the plate exponentially, since the beam particles participating in the coherent amplification of the magnetostatic oscillations are those located at a distance of the order of $1/\beta$ from the surface of the plate. For frequencies on the order of 10^{-10} sec^{-1}, the increment has an approximate value 10^{-3}. Orig. art. has: 19 formulas.

SUB CODE: NP, SS, EM/ SUBM DATE: 19Dec64/ ORIG REF: 002/ OTH REF: 002
ATD PRESS: 4138

Card 2/2

BAR'YAKHTAR, V.G.; SAVCHENKO, M.A.; TARASENKO, V.V.

Bound magnetoelastic waves in antiferromagnets placed in strong magnetic fields. Zhur. eksp. i teor. fiz. 49 no.3:944-952 S '65. (MIRA 18:10)

ACCESSION NR: AP5016565 UR/0056/65/048/006/1717/1722

AUTHORS: Makarov, V. I.; Bar'yakhtar, V. G.

TITLE: Anomalies in the superconducting transition temperature under pressure

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 48, no. 6, 1965, 1717-1722

TOPIC TAGS: thallium, superconductivity, pressure effect

ABSTRACT: This investigation was stimulated by the fact that thallium behaves under pressure in a manner different from other metals, and was aimed at checking the hypothesis that the nonlinear part of the pressure dependence of the transition temperature is connected with a change in the topology of the Fermi surface under pressure. The hypothesis is verified by starting out from a very simple model of superconductivity, the authors show that the change

L 1561-66

ACCESSION NR: AP5016565

change in the topology of the Fermi surface is associated with the pressure-induced change in the Fermi energy, and compute the variation of the superconducting transition temperature with variation of this energy. The relative change of the transition temperature is found to be of the order of the square root of the ratio of the Debye temperature to the Fermi energy. The relation between the transition temperature and the impurity concentration is also investigated. "The authors thank A. I. Akhiyezer, B. G. Lazarev, T. A. Ignat'yeva, and N. S. Tereshina for a discussion of the results." Orig. art. has: 2 figures and 12 formulas.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSSR (Physicotechnical Institute, Academy of Sciences, UkrSSR)

SUBMITTED: 15Jan65 ENCL: 00 SUB CODE: GP

NR REF SOV: 007 OTHER: 004

Card 2/2

ACCESSION NR: [illegible]

APPROVED FOR RELEASE: 06/06/2000 CIA-RDP86-00513R000203810009-8"

[illegible]

Theory of transfer phenomena in metals in strong magnetic fields. Zhur. eksp. i teor. fiz. 48 no.1:204-221 Ja '65. (MIRA 18:4)

1. Fiziko-tekhnicheskiy institut AN UkrSSR.

ACC NR

AUTHORS: Bar'yakhtar, V. G.; Savchenko, M. A.; Tarasenko, V. V.

ORG: None

TITLE: Coupled magnetoelastic waves in antiferromagnets in strong magnetic fields

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 49, no. 3, 1965, 944-952

TOPIC TAGS: antiferromagnetic material, uniaxial crystal, magnetic structure, magnetoacoustic effect

ABSTRACT: The authors consider coupled magnetoelastic waves in a uniaxial antiferromagnet, the ground state of which is determined (in the absence of an external magnetic field) by two compensated sublattices. The angle between the magnetic moment of the sublattices is assumed to differ appreciably from 180°. The antiferromagnet is assumed to have magnetic anisotropy of the easy-axis type. The spectrum of the coupled magnetoelastic wave is determined by the standard procedure of diagonalizing the Hamiltonian. The results show that the strongest coupling is produced between nonactivated spin and longitudinal sound waves, with the latter being excited in the antiferromagnet only if the

ACC NR: AP5024717

alternating magnetic field is polarized along the direction of the resultant magnetization. The relative corrections to the frequencies (phase velocities) of the sound and magnetic waves during magnetoacoustic resonance are determined, and the amplitude of the longitudinal sound oscillations induced by an alternating magnetic field is calculated. It is shown that excitation of longitudinal sound waves occurs only if the alternating magnetic field is parallel to the constant magnetization axis. The corrections to the velocities of the sound (elastic) and spin (magnetic) waves are found to amount to several per cent even outside the region of magnetoacoustic resonance. Orig. art. has: 32 formulas

SUB CODE: 20/ SUBM DATE: 19Apr65/ NR REF SOV: 006/ OTH REF: 002

L 15364-66 EWT(1)/EWT(m)/EWA(d)/EWP(t)/EWP(z)/EWP(b)
ACC NR: AP5000024 SOURCE CODE: UR/

AUTHORS: Bar'yakhtar, V. G.; Savchenko, M. A.; Tarasenko, V. V.

ORG: Physicotechnical Institute, Academy of Sciences UkrSSR (Fiziko-tekhnicheskiy institut Akademii nauk UkrSSR)

TITLE: Inhomogeneous resonance in antiferromagnets

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 49, no. 5, 1965, 1631-1636

TOPIC TAGS: antiferromagnetic material, magnetic moment, magnetic anisotropy, magnetic resonance, external magnetic field

ABSTRACT: The article deals with the characteristic frequencies of an antiferromagnetic plate for the case when the field and the deviations of the magnetic moments from their equilibrium values are inhomogeneous, and the magnetic moments of the sublattices lie in the plane of the plate. The calculations are made in the magnetostatic approximation for antiferromagnets with two types of anisotropy, an axis and a plane of easy magnetization. It is shown that the charac-

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ACC NR: AP6000224

teristic frequencies lie within a strictly defined interval the width of which is of the order of 1/δ (δ is the constant of homogeneous exchange interaction between the sublattices). The dependence of the limiting frequencies of the inhomogeneous resonance on the external magnetic field is determined over a wide range of magnetic fields so that the frequency interval within which the frequencies of inhomogeneous resonance lie is evaluated as a function of the variation of the external magnetic field. Authors thank A. S. Borovik-Romanov who called their attention to this problem. Orig. art. has: 4 figures and 20 formulas.

SUB CODE: 20/ SUBM DATE: 19Jun65/ ORIG REF: 004/ OTH REF: 002

Card 2/2

L 17655-66 EWT(1) IJP(c) GG

ACC NR: AP6002728 SOURCE CODE: UR/0056/65/049/006/1858/1867

AUTHORS: Bar'yakhtar, V. G.; Fal'ko, I. I.; Makarov, V. I

ORG: Physicotechnical Institute, Academy of Sciences SSSR (Fiziko-tekhnicheskiy institut Akademii nauk SSSR); Khar'kov State University (Kar'kovskiy gosudarstvennyy universitet)

TITLE: Effect of impurities on the superconducting transition temperature

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 49, no. 6, 1965, 1858-1867

TOPIC TAGS: superconductivity, phase transition, impurity scattering, critical point, electron interaction

ABSTRACT: The authors investigate the effect of diamagnetic impurities on the superconducting transition temperature for the case when addition of impurities makes it possible to modify the topology of the Fermi surface of the superconductor. This is done by determining the nonlinear change in the temperature T_k ($\sim \sqrt{n}$ ln n, where n is the

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impurity density) of the superconducting transition with change in the Fermi-surface topology. It is assumed that the anisotropy of the electron-electron interaction is small and only the nonlinear change in T_k under the influence of the impurities, due to modification of the Fermi-surface topology is considered. It is shown that this mechanism, unlike that considered by D. Markowitz and L. P. Kadanoff (Phys. Rev. v. 131, 563, 1963) may lead to both a nonlinear decrease and a nonlinear increase of T_k with increasing impurity concentration. The expression derived for T_k consists of the value of T_k for the pure semiconductor, plus a term which allows for the combined effect of the singularities in the topology of the Fermi surface and the scattering of the electrons by the impurities. Author thanks A. I. Akhiyezer, I. A. Akhiyezer, I. M. Lifshits, and G. M. Eliashberg for a discussion of the work. Orig. art. has: 1 figure and 41 formulas.

SUB CODE: 20/ SUBM DATE: 24Jun65/ ORIG REF: 014/ OTH REF: 006

ACC NR: AP SOURCE CODE: UR/ /65/ /1934/1937

AUTHORS: Bar'yakhtar, V. G.; Makarov, V. I.

ORG: Physicotechnical Institute, Academy of Sciences Ukrainian SSR (Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR)

TITLE: On the effect of pressure on the superconducting transition temperature

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 49, no. 6, 1965, 1934-1937

TOPIC TAGS: pressure effect, superconductivity, phase transition, crystal lattice structure, metal property, indium, mercury, zinc, cadmium, zirconium, molybdenum, lanthanum, thallium

ABSTRACT: Starting from the well known expression for the temperature of the superconducting transition, the authors derive an expression for the derivative of this temperature with respect to the pressure in terms of experimentally observable quantities such as the Gruneisen constants of the electron and of the lattice, and the compressibility

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ACC NR: AP6002238

of the metal. Calculations based on the derived expression are in satisfactory agreement with the experimentally determined values for the majority of pure superconducting ... The comparison is based on the assumption that the formula derived ... not only for quadratic dispersion law, but for an arbitrary ... electron dispersion. The Gruneisen constant for the metals In, Hg, Tl, Cd, Zr, Mo, and LaB differ from the average value (γ_e ...) by no more than $\pm(0.1 - 0.2)$. Certain anomalies in the pressure dependence of thallium are briefly discussed. The authors thank B. G. Lazarev for a discussion of the work. Orig. art. has: formulas and 1 table.

SUB CODE: 20/ SUBM DATE: 20Jul65/ ORIG REF: 006/ OTH REF: 009

Card 2/2 [illegible]

ACC NR: AT6031153 SOURCE CODE: UR/3137/65/000/000/0003/0018

AUTHOR: Bar'yakhtar, V. G.; Savchenko, M. A.; Stepanov, K. N. 62

ORG: none B+1

TITLE: Interaction of plasma and spin waves in ferromagnetic semiconductors and metals

SOURCE: AN UkrSSR. Fiziko-tekhnicheskiy institut. Doklady, no. 244/T-027, 1965. O vzaimodeystvii plazmennykh i spinovykh voln v ferromagnitnykh poluprovodnikakh i metallakh, 3-18

TOPIC TAGS: semiconductor, spin wave, ferromagnetic semiconductor, plasma wave, semiconductor plasma

ABSTRACT: A study is conducted of coupled spin, plasma, and electromagnetic waves in ferromagnetic semiconductors and metals at arbitrary wave propagation directions. The refractive indices and transmission regions of these ferromagnetic semiconductors and metals are determined. Orig. art. has: 41 formulas. [Authors' abstract] [SP]

SUB CODE: 20/ SUBM DATE: none/ ORIG REF: 006/ OTH REF: 002

metal physics 18

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L 22253-66 EFF n -2/EWT(1)/EWT(m) ... SOURCE CODE: UR/0056/66/050/003/0576/0588

AUTHOR: Bar'yakhtar, V. G.; Savchenko, M. A.; Stepanov, K. N. 80 B

ORG: Physicotechnical Institute, Academy of Sciences, Ukrainian SSR (Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR)

TITLE: Interaction of plasma and spin waves in ferromagnetic semiconductors and metals

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 50, no. 3, 1966, 576-588

TOPIC TAGS: spin wave, ferromagnetism, magnetic permeability, Larmor radius, magnon, plasma physics, ferromagnetic material, semiconducting material, metal, magnetic anisotropy

ABSTRACT: Bound plasma, and electromagnetic and spin waves in ferromagnetic semiconductors and metals with magnetic anisotropy of the "easy axis" and "easy plane" type are considered. The region of wave vectors κ is investigated in which space dispersion of the magnetic permeability tensor may be significant, but space dispersion of the dielectric permittivity is weak (the wavelength is much greater than the Larmor electron radius and the phase velocity of the waves is much greater than the thermal of Fermi velocity of the electrons). The

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ACC NR: AP6010978

indices of refraction waves and the transparency regions are determined. It is shown that bound waves in the plasma in the absence of space dispersion of the ε tensor possess normal dispersion). The spectra of bound cyclotron and spin waves moving perpendicular to the magnetic field are also determined in the case when the wavelength is of the order of the Larmor electron radius. [CS]

SUB CODE: 20/ SUBM DATE: 07Oct65/ ORIG REF: 006/ OTH REF: 002/

Card 2/2 nst

L 43052-66 EWT(1) IJP(c) GG

ACC NR: AP6015462 SOURCE CODE: UR/0181/66/008/005/1449/1454

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B.

AUTHOR: Bar'yakhtar, V. G.; Sanina, V. A.

ORG: none

TITLE: The scattering of spin waves on paramagnetic impurities in antiferromagnetics 21 21

SOURCE: Fizika tverdogo tela, v. 8, no. 5, 1966, 1449-1454

TOPIC TAGS: spin wave, electromagnetic wave scattering, antiferromagnetic material, weak magnetic field, impurity scattering, magnetic anisotropy

ABSTRACT: The scattering of spin waves in impurities in antiferromagnetics with a "light axis" magnetic anisotropy in weak magnetic fields has been studied by R. London and P. Pincus (Phys. Rev., 132, 673, 1963). The present authors study the scattering of spin waves in impurities in antiferromagnetics with a "light plane" magnetic anisotropy, as well as in antiferromagnetics with a "light axis" magnetic anisotropy in magnetic fields the intensity of which is greater than the "upsetting" field. Assuming k = 0 and integrating by k2, in the case of antiferromagnetics with a "light plane" magnetic anisotropy, the authors obtain

$$\frac{1}{\tau_{1e}}=\frac{c}{128}\left(\frac{4\pi}{\delta}\right)^{1/2}\left(\frac{\delta'}{\delta}\right)^{2}\left(\frac{\varepsilon_k}{\Theta_e}\right)^{3}\frac{\varepsilon_k}{\hbar}, \quad c\equiv\frac{N_1}{N}, \qquad (1)$$

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where c is the relative impurity concentration. The quantity defines the width of the line of antiferromagnetic resonance which is determined by the scattering of the spin waves on the impurities ($\varepsilon_0 = \hbar\omega_0$ — is the frequency of the spin waves with a wave vector equal to zero). For $MnCO_3$, in which $\varepsilon_0 = 3.4 \cdot 10^{-6}$ erg, $\theta_0 = 4.5 \cdot 10^{-15}$ erg, $\frac{1}{\tau_{10}} = 2.5 \cdot 10^{5}$ sec^{-1}. In the case of antiferromagnetics with a "light axis" magnetic anisotropy, the authors obtain

$$\frac{1}{\tau_{10}} = \frac{c}{64\pi^3}\left(\frac{4\pi}{\delta}\right)^{1/2}\left(\frac{\delta'}{\delta}\right)^2\left(\frac{H_\beta}{M_0}\right)^{1/2}\left(\frac{\varepsilon_0}{\theta_0}\right)^2\frac{\mu H}{\hbar}\times$$
$$\times\left[\frac{\pi}{4}\left(1+\ln\frac{2H_{cr}}{H}\right)-\frac{\pi}{16}\left(\frac{H_{cr}}{H}\right)^2\left(1+2\ln\frac{H_{cr}}{H}\right)\right],$$

where $H_\beta = (\beta - \beta_{12})M_0$. For MnF_2, in which $H_\beta = 10^4$, $H_\delta = 10^6$, $H_{cr} = 9 \cdot 10^4$ e, $M = 500$ G, $\theta_0 = 10^{-14}$ erg, which is located in the external field $H = 2 \cdot 10^5$ e, $\frac{1}{\tau_{10}} = 5 \cdot 10^{5}$ sec^{-1}. The evaluations are performed assuming that $\frac{\delta'}{\delta} \approx 10$. In conclusion, the authors express their gratitude to A. G. Gurevich for interest in the work and useful discussions. Orig. art. has: 21 formulas.

SUB CODE: 20/ SUBM DATE: 29Sep65/ ORIG REF: 005/ OTH REF: 002

L 45098-66 EWT(1)/T IJP(c) GG/AT

ACC NR: AP6024886 SOURCE CODE: UR/0056/66/051/001/0250/0257

AUTHOR: Bar'yakhtar, V. G.; Rudashevskiy, Ye. G.; Savchenko, M. A.; Stepanov, K. N.

ORG: Physico-technical Institute, Academy of Sciences, Ukrainian SSR (Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR)

TITLE: Interaction between electromagnetic, plasma and spin waves in antiferromagnetic semiconductors and metals

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 51, no. 1, 1966, 250-257

TOPIC TAGS: plasma wave, spin wave, antiferromagnetic material, magnetic susceptibility, electromagnetic wave

ABSTRACT: Coupled electromagnetic, plasma, and spin waves in antiferromagnetic semiconductors and metals are investigated. Since there are two spin waves in antiferromagnetics (unlike ferromagnetics, which have one), the spin and electromagnetic (plasma) wave interaction pattern in the former is more complex than in the latter. However, in antiferromagnetics the magnetic susceptibility is proportional to a small parameter χ_0 (static susceptibility), and the spin and electromagnetic oscillation coupling is therefore weak. In the region in which the frequencies of the noninteracting spin and electromagnetic (plasma) braches intersect, the frequency corrections due to wave coupling is of the order of $\sqrt{\chi_0}$, and far away from the intersection region they are of the order of xo. Orig. art. has: 32 formulas. [CS]

SUB CODE: 20/ SUBM DATE: 24Jan66/ ORIG REF: 005/ OTH REF: 004/

Card 1/1 blg

L 05613-67 EWT(1) GG

ACC NR: AP6024484 SOURCE CODE: UR/0181/66/008/007/2168/2172

AUTHOR: Bar'yakhtar, V. G.; Savchenko, M. A.; Stepanov, K. N. 55

ORG: none B

TITLE: Interaction of electromagnetic and spin waves in helicoidal magnetic structures

SOURCE: Fizika tverdogo tela, v. 8, no. 7, 1966, 2168-2172

TOPIC TAGS: spin wave, electromagnetic wave, magnetic structure, antiferromagnetism, refractive index

ABSTRACT: The authors consider coupled spin and electromagnetic waves and their propagation in antiferromagnets with helicoidal magnetic structure and derive analytic expressions for the frequencies of the interacting waves. The different modes of oscillations that can exist in the antiferromagnet are illustrated as functions of the frequency dependence of the refractive index. It is shown that near the points of intersection of the spin and electromagnetic branches, the coupling parameter has an order of magnitude $\sqrt{\zeta}$, while far from this point it is proportional to ζ ($\zeta = g\mu^2 S/Ia^3 \sim 10^{-3}$, where g is the Lande factor, μ is the Bohr magneton, S the spin of the atom, I the exchange integral, and a the lattice constant). Orig. art. has: 2 figures and 15 formulas

SUB CODE: 20/ SUBM DATE: 29Dec65/ ORIG REF: 005/ OTH REF: 002

Card 1/1 egh

GAYDA, R.P.[Haida, R.P.]; VISHNEVSKIY, V.N.[Vyshnevs'kyi, V.N.], dots., otv. red.; BAR'YAKHTOR, V.G.[Bar'iakhtor, V.H.], dots., retsenzent; KVITKO, I.S., red.

[Atomic physics] Atomnaia fizyka. L'viv, Vyd-vo L'vivs'koho univ., 1965. 352 p. (MIRA 18:9)

L 40754-55

APPROVED FOR RELEASE: 06/06/2000 CIA-RDP86-00513R000203810009-8"

Card 1/2

BARYBIN, K. S.

Sbornik geometricheskikh zadach na dokazatel'stvo. Posobie dlia uchitelei /Collection of geometry problems for proving; teachers' manual/. Moskva, Uchpedgiz, 1952. 152 p.

SO: Monthly List of Russian Accessions, Vol. 7, No. 3, June 1954.

BARYBIN, K.S.; PAZEL'SKIY, S.V., redaktor; MAKHOVA, N.N., tekhnicheskiy redaktor.

[Collection of geometry problems for demonstration; manual for teachers] Sbornik geometricheskikh zadach na dokazatel'stvo; posobie dlia uchitelei. 2-e izd. Moskva, Gos. uchebno-pedagog. izd-vo Ministerstva prosveshcheniia RSFSR, 1954. 151 p. (MLRA 8:1)
(Geometry--Problems, exercises, etc.)

BARYBIN, K.S.

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Rid a useful handbook of shortcomings. ("Collection of geometrical problems to be proved." K.S.Barybin. Reviewed by G.L.Eidinov. Mat. v shkole no.6:84-86 N-D '54. (MLRA 7:11)

(Barybin, K.S.) (Geometry--Problems, exercises, etc.)

BARYBIN, K. S.

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So: Knizhnaya Letopis', No. 10, 1956, pp 116-127

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BARYBIN, K.S. (Moskva); GOLUB, A.M. (Sumy); CHERTKOV, I.Ya. (Sumy); BEKKER, M.B. (Tallin).

"Trigonometry textbook" by S.I.Novoselov. Reviewed by K.S.Barybin and others. Mat.v shkole no.5:65-87 S-O '57. (MLRA 10:9)
(Tigonometry--Textbooks) (Novoselov, S.I.)

BARYBIN, Konstantin Sergeyevich; LEPESHKINA, N.I., red.; NATAPOV, M.I., tekhn. red.

[Collection of problems in plane geometry; teacher's aid] Sbornik zadach po geometrii (planimetriia) posobie dlia uchitelei. Moskva, Gos. uchebno-pedagog. izd-vo M-va prosv. RSFSR, 1958. 180 p. (Geometry, Plane—Problems, exercises, etc.) (MIRA 11:10)

BARYBIN, K.S. (Moskva)

Readers' notes and letters. Mat.v shkole no.4:57-58 Jl-Ag '59. (MIRA 12:11)

(Geometry--Study and teaching)

BARYBIN, K.S. (Moskva)

From letters and remarks of readers. Mat. v shkole no.6:62-63 N-D '59. (MIRA 13:3)

(Equations, Quadratic)

BARYBIN, YU.G.

protsessov v mashinostroyenii i avtomatizirovannomu elektroprivodu v promyshlennosti. 3d, Moscow, 1959

Elektroprivod i avtomatizatsiya promyshlennykh ustanovok; trudy soveshchaniya (Electric Drive and Automation in Industrial Systems; Transactions of the Conference) Moscow, Gosenergoizdat, 1960. 470 p. 11,000 copies printed.

General Eds.: I.I. Petrov, A.A. Sirotin, and M.G. Chilikin; Eds.: I.I. Sud, and K.F. Silayev; Tech. Eds.: K.P. Voronin, and G.Ye. Larionov.

PURPOSE: The collection of reports is intended for the scientific and technical personnel of scientific research institutes, plants and schools of higher education.

COVERAGE: The book is a collection of reports submitted by scientific workers at plants, scientific institutes and schools of higher education at the third Joint All-Union Conference on the Automation of Industrial Processes in Machine Building and Automated Electric Drives in Industry held in Moscow on May 12-16, 1959. The Conference was called by the Academy of Sciences USSR, the Gosplan SSSR (State Planning Commission USSR), the GNTK SSSR, the Gosudarstvennyy komitet po avtomatizatsii i mashinostroyeniyu (State Committee on Automation and Machine Building) and the Natsional'nyy komitet SSSR po avtomaticheskomu upravleniyu (USSR National Committee on Automatic Controls) and prepared by the Nauchno-tekhnicheskiy komitet po avtomatizirovannomu elektroprivodu (Scientific and Technical Committee on Automated Electric Drives), the MEI (Moscow Institute of Energetics), the VNIIEM, the IAT (Institute of Automation and Telemechanics) of the Academy of Sciences USSR, and the Komissiya po tekhnologii mashinostroyeniya Instituta mashinovedeniya AN SSSR (Commission on the Technology of Machine Building of the Institute of Science of Machines of the Academy of Sciences USSR). It was the purpose of the Editorial Board to arrange the reports in a way which would ensure a relatively systematic presentation of theoretical and practical problems relating to electric drives and automatic controls of industrial mechanisms used in various branches of industry. Basic problems of automated electric drive and their solution are outlined. The book also contains articles on electric machinery and means of automation. Considerable attention is paid to noncontact automatic control systems, including systems with semiconductor devices and magnetic amplifiers, and to computers intended both for the analysis and the synthesis of linear and nonlinear automatic regulation and control systems. Reports already published in journals or official publications have been considerably abbreviated; those which have appeared in volume V of EII EP transactions or in the journal "Elektrichestvo" are marked with an asterisk. No personalities are mentioned. References accompany some of the papers.

PART I. GENERAL PROBLEMS CONCERNING THE THEORY AND PRACTICE OF ELECTRIC DRIVE AND AUTOMATION OF CONTROL